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<tr><td>MANAGEMENT SYSTEMS/PROCESSES PART I: CONTRACTOR MANAGEMENT SYSTEMS

NASA major program or project contractors operate using management systems. These systems consist of a set of collective processes that are used to manage internal operational activities. Typical management systems used by NASA contractors must meet customer contract requirements and be compliant with applicable Government requirements and methodologies. NASA contractor surveillance personnel must understand these systems in order to strengthen the Government's ability to monitor and assess the vast spectrum of tasks performed by the contractor.

This module, Part I of the Management Systems/Processes training, covers the contractor management systems most likely to be encountered by NASA contractor surveillance personnel. To keep the module focused on contractor functional system operations, closely related topics such as contract performance tasks and contractor in-plant interfaces that are covered in other modules are not repeated here. Reference pointers to these related topics will be maximized to achieve overall training continuity.</td><td>Slide # I-1</td></tr>
<tr><td>MODULE TRAINING OBJECTIVES

This slide states the objectives of the Management Systems/Processes Training Module.

The first objective is to recognize the major functional management systems most often used by key NASA contractors. The goal is to establish this recognition at an awareness level rather than to master the details of each system.

The second objective is to demonstrate an understanding of the roles of key contractor and government players.

The third objective is to recognize general criteria used to judge how effective a contractor's management system is operating.

The final objective is to be able to identify examples of typical system activities, events, and products.</td><td>Slide # I-2</td></tr>
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
OUTLINE This slide presents the outline for the Management Systems/Processes training module. The training overview begins by identifying students' backgrounds in an effort to tailor the class to their specific interests and needs. A discussion of typical contractor practices and procedures introduces a section that establishes the baseline definition for management systems. The next section serves to familiarize the student with typical NASA management systems. It begins with a discussion of the important aspect of the Government's right of approval and/or disapproval. This discussion is followed by an introduction of the NASA functional management systems that will be covered in the module. Each of these identified systems is then discussed in successive sections of the module. These discussions cover topics such as system descriptions, key players, criteria to identify a satisfactory system performance, and typical examples of system activities. The module concludes with a 15-minute summary. An overview of Government methodologies, such as ISO 9000 and Mil-Q-9858A and DCMC/DCAA surveillance as they pertain to Government surveillance methodologies, is covered in another module.	Slide # I-3
OVERVIEW This slide introduces the topics covered in the overview section of the module. It consists of three slides that (1) address the intended audience of the training, (2) discuss the way in which contractor practices are defined by policies and procedures, and (3) provide a baseline definition of management systems that will be used for the rest of this module.	Slide # I-4
OVERVIEW: WHO IS IN ATTENDANCE? As previously indicated, this particular module is intended for NASA personnel charged with the task of in-plant contractor surveillance. Because of the wide range of NASA missions and large cast of supporting contractors, there is no canned in-plant environment or standard set of management functions. This module will address those management functions that have historically proven to be the most commonly used by NASA major program and project suppliers. It is important to consider the specific backgrounds of all participants in order to tailor course emphasis to their needs.	Slide # I-5 Suggestion: Class instructor can lead an open discussion on student backgrounds

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
OVERVIEW: TYPICAL CONTRACTOR PRACTICES This slide shows a simplified version of the process in which top-level management policies and procedures flow down to establish specific functional procedures at the departmental level (e.g., quality assurance). To effectively articulate top-level policies and procedures, contractors must have established written documentation that defines the business' objectives and strategies and tells how they are to be executed. This is true regardless of the company size. The hierarchy of policies and procedures addresses the necessary communications required to receive customer contract requirements and transform them into products. This process generally starts at the top corporate level where the overall objectives and strategies for the business line or commodities are defined. If large enough, the corporation will have individual divisions or companies for defined business commodities that will operate as separate profit centers. The company will have unique policies to address company-wide matters. Below the company level, departments such as quality assurance will operate to manage their functional tasks. Each department will provide specific guidance for its employees. These instructions are commonly referred to as work or office instructions. The importance of NASA missions and the corresponding assets invested in those missions through program or project contracts dictates that a contractor possess processes that can adequately translate NASA requirements into the completed end item product. This transformation involves a multitude of activities, which include contract review, training of personnel, engineering, building the design, and verification through testing, analysis, and inspection. An important point to remember is that it is the processes defined by contractor management systems that must produce a quality NASA product and, consequently, mandate the need for NASA in-house personnel to have an understanding of the contractor management systems.	Slide # I-6 Reference: Module VI.A, Contractor Performance Surveillance Overview.

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OVERVIEW: WHAT IS A MANAGEMENT SYSTEM?

The phrase “management system” has been previously mentioned. So, what is a management system? The Air Force contract administration services guidance defined a contractor management system in this way:

“A network of company-wide objectives and policies, together with the corresponding assignments of authority and responsibility, passed by the chief operating official (COO) to functional area managers.”

For the purposes of this training, this definition is very appropriate. The key thought is one of a process with inputs and outputs. This concept is expressed in ISO 9000-1, Quality Management and Quality Assurance Standards - Part 1. Instead of a physical or manufacturing type process, the process here is one of management. Inputs to the process come from the customer through a NASA contract and to the contractor through the development of contract specific requirements. The process itself is the set of functional procedures that convert the requirements into the output or product. ISO 9000-1 suggests the process adds value to the input to make it the output.

A good example of a contractor management system that should be faMiliar to all of the students is quality assurance. ISO 9000 defines a quality system as follows:

“The process, organizational structure, procedures, and resources that manufacturers and suppliers use to control these variables to produce a product of consistent quality which meets defined specifications.” Examples of variables include “type of equipment used in design, production ... testing and shipping; the equipment calibration and maintenance procedures employed; the training ... of ... personnel; level of ‘workmanship;’ and ... environmental conditions ...”
</td><td>
Slide # I-7

<u>Reference</u>: ISO 9000-1, Quality Assurance Standards - Part I

<u>Reference</u>: NISTIR 4721 Report: Questions and Answers on Quality, the ISO 9000 Standard Series, Quality System Registration, and Related Issues (Revised July 1992)
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
CONTRACTOR MANAGEMENT SYSTEMS This is the main section of the Management Systems and Processes training module. It begins by explaining what rights the Government has regarding approval and disapproval of management system-related issues. This issue is addressed up front because of its basic importance to all of the management systems that follow. The remainder of this section is divided into eight subsections for each of the eight management processes identified to be covered in this module.	Slide # I-8
CONTRACTOR MANAGEMENT SYSTEMS: OVERVIEW OF GOVERNMENT RIGHTS Prior to discussing specific functional management systems, a quick review of the Government approval or the "right of disapproval" as related to contractor management systems should be addressed. By virtue of contract terms and clauses cited from the Federal Acquisition Regulation, certain systems will be specified for explicit Government approval. Specific clauses such as the "Inspection Clause" placed in contracts give the Government specific rights of data and facility access to conduct assessments. It is important, however, to again emphasize that the Government will always reserve the right to disapprove. Module III.C, (Ref: III.C, Contractor Interfaces - Prerogatives of Government to Disapprove Procedures) gives these advantages for this strategy: • "The contractor retains the accountability to manage performance to meet Government contract terms. • Government resources can be applied selectively to those key areas of surveillance that are needed to protect the Government's best interests. • Procedures remain the contractor's method of doing business and not a consequence of Government direction. • Deficiencies in contractor processes and any resulting unsatisfactory performance can not be justified by the contractor as in compliance to Government-approved procedures or as a result of direct Government direction. • Contractor planning and operations are not dependent on timely Government approval and direction. • Contractor is incentivized to continuously improve operating procedures."	Slide # I-9 Reference: Contractor Interfaces, Module III.C, RMO In-plant Relationships/ Interfaces discusses systems specified for explicit government approval. Reference: Contractor Interfaces, Module III.C, Contractor Interfaces - Prerogatives of Government to Dispprove Procedures

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS

CONTRACTOR MANAGEMENT SYSTEMS: OVERVIEW OF GOVERNMENT RIGHTS (CONCLUDED)

Slide # I-10

For those contractor procedures executed in performance of NASA contracts, the Government will normally only approve a limited number of systems. The two systems and related procedures that are explicitly approved by the Government contracting officer are the Property Management System and the Purchasing System.

Systems and management procedures that are not directly approved include the following:

- Estimating System
- Quality Assurance System
- Material Planning Procedures
- Engineering Management System
- Manufacturing Management System
- Test Operating Procedures

The Government reviews and assesses the existence, adequacy, and compliance of contractor performance on NASA contracts to these systems and procedures. The Federal are Acquisition Regulation (FAR) Part 42 requirements are used for this company-wide assessment, which is often performed by the resident Defense Contract Management Command (DCMC) personnel.

As a result of this assessment, noted deficiencies should be identified and corrective action pursued. Unless deficiencies are of a major nature, Government disapproval of most systems will not be exercised. The emphasis here is on management systems and not contract line items. This "right of disapproval" is distinct from program or project contract-specific terms to approve deliverable data, such as a quality assurance plan or a safety plan. If significant system deficiencies identified by the Government go uncorrected, the contracting officer may withdraw granted privileges such as Material Review Board. In an extreme case, the contracting officer may indeed disapprove the contractor's quality management system from being used on the NASA contract. The consequences are severe if this happens.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS

CONTRACTOR MANAGEMENT SYSTEMS: TYPICAL FUNCTIONAL MANAGEMENT SYSTEMS

Slide # I-11

The management structure of NASA contractors can vary significantly. Many factors can influence the specific organizational styles. Factors such as the size of employment, corporate objectives, business commodity, senior management preferences, and customer base are just a few. For example, consider the influence that NASA or a Military customer might have on the contractor internal operations. These customers have risks at a very high level and must demand tremendous insight into contract progress. Most contractors will operate along the lines of generic systems or, as sometimes called, management processes.

This does not mean that all contractors call their functions the same name. For example, you will occasionally see quality assurance called product assurance. Regardless of the name, the functional quality assurance tasks must be done. Recognizing the variety of NASA contractor organizational structures, this module will concentrate on the common functional systems. In-plant experience has shown that there are basically seven systems that play a vital role in contractor internal operations to meet customer needs. Again, names may vary from facility to facility, but these are the most likely management systems:

- Contract Management
- Safety
- Government Property
- Manufacturing Operations
- Quality Assurance
- Design Engineering
- Purchasing/Subcontract Management
- Data Management

Each of these management systems will now be addressed. Our discussion will include a description of the management system; its key players; general criteria suggested for satisfactory performance; and examples of typical system activities, events, and products.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
CONTRACT MANAGEMENT: DESCRIPTION Government contracts entail significant administrative and reporting requirements. The contractor normally has a contract administration or procurement department that is typically responsible for contractor compliance with these requirements. This organization is where you will find the counterpart of the Government contracting officer. Simply stated, this function takes care of the contract issues. Within the contractor's organizational structure, there will most likely be a distinct contract or procurement department. Often, this department will be an arm reporting to the controller who has overall company financial management chores. Because of the high level of risk involved, the controller is usually at the highest management or executive level, such as vice president. The flow diagram in the chart is a simplified depiction of how this reporting process may occur.	Slide # I-12
CONTRACT MANAGEMENT: AREAS OF FUNCTIONAL RESPONSIBILITY Despite its many tasks, contract management can generally be grouped into the areas of fuctional responsibility shown on this chart. Each area on its own can be a detailed subject, but our objective is to gain an awareness of its existence and purposes. For now, a simple description will be given for each. Players, criteria, and activities will be discussed later. Contract Administration is the business management of the customer contracts that entail those significant administrative and reporting requirements. The contractor's contracting officers and staff will most likely perform these tasks. Performance Measurement tracks the cost and schedule of programs and internal operations. It provides the control mechanisms to ensure that management is systematically tracking program cost and schedule. The Estimating System generates the proposals to provide the basis for negotiations with the customer and the eventual contracts. This system is of extreme importance to the Government. Forward Pricing is one of the functional jobs that must exist to facilitate the pricing of procurement actions. Forward Pricing Rate Agreements (FPRAs) are advance agreements between the Government and the contractor on labor and overhead rates. Without these agreements, each contract change would require re-negotiation of rates. FPRAs are usually negotiated by the Contract Administration Office (CAO). Indirect Cost Control relates to the contractor management of allowable indirect costs and compliance to federal cost accounting standards.	Slide # I-13

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
CONTRACT MANAGEMENT: KEY PLAYERS Continuing our look at the contractor management systems, we need to address the players involved for both the Government and the contractor. As with any contractor management structure, the players involved will vary. The players that are actively engaged in contract performance will be driven by the program/project needs, contractor organizational style, the contract type, and the particular phase of a program or project. For the contract management system, the key people for the Government obviously include the principal contracting officer (PCO), contract administrators (sometimes called buyers), and the Program/Project Office staff. DCMC and DCAA may be involved if Federal Acquisition Regulation (FAR) delegations are issued to the cognizant contract administration office (CAO). One of the key players in this case for the CAO will be the Administrative Contracting Officer or ACO. The ACO will be assigned the responsibility to administer contract tasks such as allowability of costs. On the contractor side, siMilar people will be involved, including the controller, the contracting officer, and the assigned direct contract support staff.	Slide # I-14
CONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA What constitutes a satisfactory management system in the surveillance eyes of the Government? As expected, specifics will depend on the contract and the individual contractor, but every system should meet the same general criteria. We will present some suggested criteria that can be used to assess the contract management system. Please keep in mind these criteria are suggestions and are not all inclusive. Contract Administration requires significant interaction between the Government and contractor officials. Because contract administration spans virtually all aspects of business operations, internal communications are especially key. This necessitates that the contractor system clearly assign and state what the authority and responsibilities are for all of the aspects of contract administration. For instance, as with the Government, engineers must provide the supporting technical rationale for design changes to contract configuration items. The contract requires justification, and the engineers should be energized to procedurally provide the needed information. A written set of policies and procedures ensures specific NASA contract terms and provisions are covered. The procedures	Slide # I-15

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
CONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONTINUED) should integrate company-wide efforts in a systematic way to provide timely information to the Government and all involved internal parties. To track NASA program costs and schedule performance, the contractor must have a control process. A satisfactory control system will be sufficiently detailed and objective to provide management insight about whether or not the estimates at completion and the control of cost and schedule are reasonable. The validity of baseline adjustments, accuracy of variance analyses, effectiveness of corrective actions, use of management reserve, and impacts of changes to budgets and schedules are other key aspects that should be covered by an effective control system.	Slide # I-15 (concluded)
CONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONTINUED) As previously stated, the estimating system generates proposals for contracts. New contracts sustain the business. A satisfactory contractor estimating system will provide detailed guidance on how these proposals will be developed, supported, and submitted. The system should ensure techniques are in place to provide timely submission of estimates and correction of system deficiencies. With Government contracts, the system must identify and provide cost/pricing data and the rationale explaining the use of such data in estimates. A satisfactory forward pricing process will have written procedures that ensure adequate planning and control of labor and overhead costs to support FPRA proposals. The FPRAs are of utmost importance to control costs and expedite the negotiation of contractual efforts. Without FPRAs, each contract would require its own negotiation of rates. This would be time consuming and extremely labor intensive. Pertinent data that support FPRAs must be reconcilable to the contractor's management plans, which become the benchmark for managing cost performance. A satisfactory system will also ensure the orderly collection of all pertinent data for use in establishing FPRAs. Management evaluations will be required of all sensitive or significant contractor functions to ensure that they are being accomplished in an efficient, cost-effective manner.	Slide # I-16

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<tr><td>CONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONCLUDED)

A satisfactory Indirect Cost Control System requires well-defined policies and procedures that specify the management and control of indirect costs. Government contracts require contractor management to “certify” that costs used on Government contracts are allowable. Incurred costs provide a basis for overhead rates and claims. The system must ensure control of incurred costs. The system must also address the compliance of the estimating system and accounting methods with contract provisions. Government contracts require strict compliance with the cost accounting standards, FAR, and NASA FAR Supplement provisions relating to cost accounting standards.</td><td>Slide # I-17</td></tr>
<tr><td>CONTRACT MANAGEMENT: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS

This chart lists several examples of products or activities that can be expected to be output from the contractor’s contract management system. Contract proposals and the resulting contract instruments should be obvious products. Likewise, post-award modifications or changes, the required cost proposals, and related negotiations should be obvious items. Cost performance reports follow the award of a contract to maintain visibility into cost control and performance. These require analysis.

The Government will periodically conduct estimating system reviews. DCAA will automatically play a key role in such reviews for large Military contractors and as requested by the NASA contracting officer for all others. Closely related to estimating reviews are progress payment reviews. Progress payment reviews monitor contractor requests for payment as permitted on certain types of contracts. Overhead reviews are conducted by DCMC and DCAA and as needed by NASA.

Labor and overhead rates were mentioned earlier. The contractor must continuously update and publish these rates as well as provide supporting information to Government reviews.

In addition, there will always be activity for issues that require resolution on interpretation of the contract, resolution of corrective actions, and closure of routine program or project matters.</td><td>Slide # I-18</td></tr>
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: DESCRIPTION The next management system to be discussed is quality assurance. Earlier, we used quality assurance to illustrate an example of a contractor management system. The definition used was taken from ISO 9000. As a quick refresher, quality assurance was defined as follows: "The process, organizational structure, procedures, and resources that manufacturers and suppliers use to control ... variables to produce a product of consistent quality which meets defined specifications." DOD gives a similar, but slightly different twist on the definition. DOD Directive 4155.1 states it this way: "A planned and systematic pattern of all actions to provide adequate confidence that adequate technical requirements are established; products and services conform to established technical requirements; and satisfactory performance is achieved." The definitions place emphasis on process and planned/systematic actions, respectively.	Slide # I-19
QUALITY ASSURANCE: DESCRIPTION (CONCLUDED) In most cases, quality assurance for the NASA contractor is managed by a department called quality assurance. You'll find variations of the name such as product assurance. To properly execute the quality assurance responsibility, it is generally believed that quality assurance should be a distinct function that is independent from engineering, manufacturing, and even program management. Some contractor organizations may align the senior-executive level along commodity or program lines, but the distinction of an independent quality assurance function will still exist. In such cases, the senior-executive functions, in essence, as the chief operating official. Look for quality to be an independent function.	Slide # I-20

QUALITY ASSURANCE: AREAS OF FUNCTIONAL RESPONSIBILITY

Slide # I-21

To provide a more complete definition of quality assurance, the areas of functional responsibility are listed on the next two charts. Recognizing once again the variety of contract environments, quality assurance can generally be defined in terms of these nine general, but key areas of functional responsibility:

- QA Management
- Quality Control Planning
- Work Instructions/Records
- Control of Nonconforming Supplies
- Correction/Detection of Nonconforming Supplies
- Supplier Quality Assurance
- Metrology/Calibration/ Tooling
- Monitor Materials, Treatments, and Processes
- Inspection and Test

Next, a quick description of each area is provided. QA Management relates to the authorities and responsibilities for managing the contractor’s documented quality management system. Quality Control Planning is the planning that is necessary to conduct the quality mission of inspection and testing. The area of Work Instructions addresses the task of ensuring the contractor work force uses only clear and current procedures or instructions for the particular job. The control of nonconforming materials assigns the authority and defines the responsibilities necessary to control the processing of nonconforming material. These actions pertain to preliminary review, Material Review Board, and Corrective Action Board activities.

One point that should be made here is that these functional responsibilities are all-encompassing for both hardware and software tasks. Contractor procedures should address all aspects of the program or project. The same can be said for quality engineering. For the purpose of this training, quality engineering will be treated as a critical skill to perform many of the functional responsibilities identified here.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: AREAS OF FUNCTIONAL RESPONSIBILITY (CONCLUDED) Continuing with our brief descriptions of the areas of functional responsibility, the Detection and Correction of Nonconforming Supplies provides the management process the ability to ensure timely detection of deficiencies and to take positive corrective action to eliminate their cause. Supplier Quality Assurance pertains to the contractor's management of the supplies and services purchased from suppliers to ensure their conformance to contract requirements. Metrology, Calibration, and Tooling addresses the quality process to ensure that there are effective metrology and calibration standards for measuring equipment and tooling. In a siMilar way, Monitor Materials, Treatments, and Processes refers to the management system that will monitor operations associated with materials, treatments, and processes such as soldering and welding. Finally, Inspection and Test is that area of quality assurance that establishes and conducts timely and controlled inspections and tests.	Slide # I-22
QUALITY ASSURANCE: KEY PLAYERS The old cliché that "quality is everyone's business" is apropos to quality insurance, but there are indeed key players who define and make the quality management system work. This chart highlights only those players considered to be the catalysts for the Government and the contractor. Specific projects may have a slightly different list, but these are the players most likely involved. It must be understood that each listed player will have support from many others. For the Government, the catalysts would routinely be the individuals directly involved in the quality assurance aspects of a program or project. The list of such players includes those shown. You can expect individuals with these assigned roles to be actively involved in contract surveillance. The Resident Management Office personnel will play an extremely vital role in monitoring daily contractor performance. Should the project require delegations, the resident DCMC can provide additional resources for delegated project tasks and a significant source of information on company-wide quality assurance issues. On the contractor team, key players will definitely include those in quality assurance management positions such as the vice president of quality or the quality manager. Generally, a contractor may designate a project quality manager to ensure close communications with the customer. This also facilitates close integration within the contractor hierarchy. The lead quality engineer will play an extremely valuable role, particularly in resolution of nonconformances and corrective	Slide # I-23

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: KEY PLAYERS (CONTINUED) action. The quality engineer should be the organization's strongest interface with design engineering. You can also expect to see individuals such as the Material Review Board (MRB) chairman, Corrective Action Board (CAB) chairman, and test manager to be highly involved players. On all projects, the individual quality inspectors and/or specialists are on the key list.	Slide # I-23 (concluded)
QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA The contractor's QA management system must have adequately documented procedures that define the functional and program/project responsibilities. This is a logical, if not contractual, requirement to ensure effective communications throughout the contractor organization. The system should clearly describe and define procedures for the quality managers, personnel training, internal audits, methods of collecting quality cost data, and closed-loop feedback on quality information and corrective actions. Authority of quality managers must be clearly established so that they have the freedom to ensure that the quality requirements of the organization and the customer contract are unquestioned. Communications with the customer and within the contractor organization must be established. Procedures must ensure that engineers talk to quality and manufacturing and vice versa. Quality can only be designed-in and built-in if everyone talks quality. Here are several pointed questions that can help you assess a contractor QA management system. Recognizing that the specific references may not be on contract, the intent of the questions is sound business. • Does the individual responsible for directing and managing the quality system have direct, unimpeded access to higher management? • Does the contractor quality system provide for audits to be conducted of personnel, procedures, and operations that implement the quality program? • Are there provisions to ensure quality information is promptly disseminated to all concerned areas and to suppliers?	Slide # I-24 Reference: ISO 9001, paragraph 4.1.2.1; Mil-Q-9858A paragraph 3.1; and NHB 5300.4 (1B-1), paragraph 1B201. Reference: NHB 5300.4 (1B-1), paragraph 1B203; and ISO 9001, paragraph 4.17. Reference: NHB 5300.4 (1B-1), paragraph 1B203; Mil-Q-9858A, paragraph 3.4, and ISO 9001, paragraph 4.16.

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QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED)

Quality control planning addresses the need for the quality system to provide for timely and effective inspection and test planning. This begins with thorough customer contract reviews to ascertain the requirements and initiate planning in the earliest project phases. The procedures must ensure that inspection and testing are compatible with the engineering drawing requirements, manufacturing methods and processes, and inspection instructions. Once implemented, the system should ensure compliance by establishing sampling techniques. Sample questions to assess this area are as follows:

• Are there provisions for quality to conduct contract review to identify inspection planning?
• Does the quality system provide for methods to review inspection and testing for compatibility with manufacturing operations, techniques, and processes?

The quality system must include the use of current and clear work instructions and records that should be readily available to QA operations. In addition to the need for the existence of adequate instructions, a continuous review and update process must be established to maintain accuracy and currency with engineering and manufacturing requirements. Inspection acceptance and rejection criteria should be provided. In addition, a mechanism for assessing the valid use of the instructions should be established. Following are sample questions that should help with surveillance of adequate work instructions and records:

• Does the contractor system provide for continuously reviewing inspection and test instructions and promptly correcting those deemed inadequate?
• Are there provisions for ensuring inspection and test instructions verify compliance with applicable drawings and specifications?
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Slide # I-25

<u>Reference</u>: Mil-Q-9858A, paragraph 3.2; and ISO 9001, paragraph 4.3.

<u>Reference</u>: NHB 5300.4 (1B-1), paragraph 1B700; Mil-Q-9858A, paragraph 3.2; and ISO 9001, paragraph 4.2.

<u>Reference</u>: Mil-Q-9858A, paragraph 3.3; ISO 9001, paragraph 4.5; and NHB 5300.4 (1B-1), paragraph 1B700.

<u>Reference:</u> Mil-Q-9858A, paragraph 6.3; ISO 9001, paragraphs 4.2, 4.10.2 and 4.10.3; and NHB 5300.4 (1B-1), paragraph 1B703.
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED)	Slide # I-26
Although contractor's objectives may be to produce perfectly conforming products, a contractor's quality system must realistically provide a segment to address nonconforming supplies. Specifically, documentation must exist to assign responsibilities and authority for critical activities associated with the management of nonconformances. This includes assigning Material Review Board, Corrective Action Board, and preliminary review.	
As part of the management of nonconforming supplies, the system must allow for the positive identification, detention, and segregation of nonconforming material from conforming material. Most contractors have special holding areas for this purpose to comply with Government contracts.	
Nonconforming supplies management involves the definition and documentation of repair, rework, and modification procedures.	
Key surveillance questions include the following:	
• Are there provisions for identifying the contractor's MRB membership?	References: Mil-Std-1520B, paragraphs 4.8 & 4.9; ISO 9001, paragraph 4.13.1; and NHB 5300.4 (1B-1), paragraphs 1B800 & 1B801.
• Does the contractor quality system provide for holding areas or procedures for nonconforming material?	References: Mil-Std-1520B, paragraph 5.3; ISO 9001, paragraph 4.13.1; and NHB 5300.4 (1B-1), paragraph 1B800.
• Do procedures assure that MRB dispositions are limited to activities for scrap; rework; return to supplier; use of Government-approved standard repair procedure; recommend repair other than approved standard repair to Government; recommend "use-as-is" dispositions to Government; and request a waiver from contracting officer for other than minor nonconformances?	References: Mil-Std-1520B, paragraph 4.10.1; ISO 9001, paragraph 4.13.1; and NHB 5300.4 (1B-1), paragraph 1B801.

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<tr><td>QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED)
The detection of discrepancies and the timely resolution of the cause of defects is vital to any commercial or Government program. The system must have the processes to force positive and thorough correction of the "root cause." Inclusive in the correction procedures should be the review and analysis of quality data and metrics to identify trends and pinpoint the scope of product defects. Methods must exist for monitoring corrective actions. If any facts are discovered that show strong evidence that they tie into the problem, they should be identified to a senior-level Corrective Action Board.
Deficiency data and the corresponding corrective action results must be communicated to other contractor functions as well as the affected suppliers. In fact, "root cause" corrective actions mandate that they be assigned to the office of primary responsibility.
Here are some leading questions to ascertain if a corrective action system is satisfactory:
• Do contractor procedures provide for analysis of quality data to identify trends and determine the extent and cause of defects?
• Are there procedures for reviewing and monitoring the effectiveness of corrective actions?</td><td>Slide # I-27

<u>Example</u>: Experience within the aerospace industry has shown repetitive minor nonconformances often are the result of overly stringent close tolerance design specifications. When trends and analysis indicate such tolerances are beyond manufacturing process capability, a producibility class II change may be in order.
<u>Reference</u>: NHB 5300.4 (1B-1), paragraph 1B802; ISO 9001, paragraph 4.14; and Mil-Q-9858A, paragraph 3.5.
<u>References</u>: NHB 5300.4 (1B-1), paragraph 1B800; ISO 9001, paragraph 4.14; and Mil-Q-9858A, paragraph 3.5).</td></tr>
<tr><td>QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED)
The contractor is responsible for assuring that suppliers conform to the contract requirements. A satisfactory QA system is one that ensures that all supplies and services from subcontractors and suppliers conform. The system should address the effectiveness of all suppliers' quality control and corrective action.
Receipt of supplies should be monitored for acceptability at receiving and inspection. Data should be collected, analyzed, and maintained to ensure effective quality control. Also, data should support the vendor rating system. Untested products and raw materials should be identified and treated separately from products that are tested and accepted. No mixing should be allowed.
The following questions can be used to help evaluate if a system can be used to effectively evaluate suppliers:
• Does contractor documentation provide for inspection of suppliers material, products, and computer software to the extent necessary on receipt to determine acceptability?
• Does the contractor's system provide for untested products and raw materials to be identified or segregated from those tested and approved?
• Does contractor documentation provide that corrective action extend to purchase products?</td><td>Slide # I-28

<u>Reference</u>: ISO 9001, paragraph 4.6.4; NHB 5300.4 (1B-1), paragraph 1B508; and Mil-Q-9858A, paragraphs 5.1 and 6.1.
<u>Reference</u>: ISO 9001, paragraph 4.10.1; NHB 5300.4 (1B-1), paragraph 1B508; and Mil-Q-9858A, paragraph 6.1.
<u>Reference</u>: ISO 9001, paragraph 4.14; NHB 5300.4 (1B-1), paragraph 1B808; and Mil-Q-9858A, paragraph 3.5.</td></tr>
</table>

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED)	Slide # I- 29
The contractor's quality program should establish an effective metrology and calibration system to oversee standards and test and measurement equipment. This system ensures the availability of certified standards, gauges, and testing and measuring equipment as well as their proper usage. Personally owned tools and production tooling used for inspection are to be included in the procedures for control. The system must provide for maintenance of records that document the control of standards and test and measurement equipment. One extremely important aspect of this process is that calibrated measurement and test equipment requires traceability to reference standards or to the National Bureau of Standards. Analysis of calibration results must be performed to establish calibration and recalibration intervals. Many test and measurement procedures require environmentally controlled areas. In these cases, it must be confirmed and documented that the procedures have, in fact, been performed under the correct environmental conditions. Pertinent questions to assess if a contractor is using satisfactory metrology and calibration processes include the following:	Note: Additional information is available in training module VI.C.4, Metrology and Calibration
• Are there procedures to ensure the use of reference standards for calibrating measuring and test equipment?	Reference: ISO 9001, paragraph 4.11; Mil-Q-9858A, paragraph 4.2; and NHB 5300.4 (1B-1), paragraph 1B900.
• Are there provisions to ensure measuring/test equipment and standards are calibrated prior to use and after prolonged periods of inactivity?	Reference: ISO 9001, paragraph 4.11; Mil-Q-9858A, paragraph 4.2; and NHB 5300.4 (1B-1), paragraph 1B900.
• Do contractor quality procedures establish criteria to be used for adjustments of calibration and inspection intervals?	Reference: ISO 9001, paragraph 4.11; Mil-Std-45662A, paragraphs 5.4 3,2,3; and NHB 5300.4 (1B-1), paragraph 1B904.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONTINUED) The monitoring of materials, treatments, and processes is an important requirement of a satisfactory contractor quality management system. NASA considers the system requirements of the quality system particularly important when inspection of hardware alone cannot assure high quality. ISO 9001 refers to "special processes" as processes in which results cannot be verified by subsequent inspection and testing of the product. Of concern with such processes is that deficiencies may not be discovered until products are finished or put into use. Examples of typical operations that should be addressed are as follows: • Soldering • Etching • Welding • Bonding • Heat Treating • Magnetic Particle • Plating/Coating • Metal Joining • Radiography • Ultrasonic • Liquid Penetrants • Plastics Material storage and proper nondestructive inspection controls are inclusive requirements. Controlled environments are an additional requirement. The following representative questions should give you an idea of the key elements of a satisfactory materials, treatments, and processes monitoring system:	Slide # I-30
• Does the system provide for monitoring processes such as soldering, welding, and heat treating?	References: Mil-Q-9858A, paragraph 6.2; NHB 5300.4 (1B-1); paragraph 1B603; and ISO 9001; paragraph 4.9.
• Are there provisions for continuous reviewing and monitoring procedures and specifications for adequacy?	References: Mil-Q-9858A, paragraph 6.2; NHB 5300.4 (1B-1); paragraph 1B603; and ISO 9001; paragraph 4.9.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: SATISFACTORY SYSTEM CRITERIA (CONCLUDED)	Slide # I-31
Inspection and testing tasks are a major part of the contractor quality assurance function. Accordingly, the quality system must ensure that inspection and test operations are established and executed under controlled conditions. The system should ensure the inspection and testing operations are satisfactorily completed in the proper sequence and time. The bottom line of effective inspection and testing tasks is that only compliant hardware, software, and data should be submitted to the customer for acceptance.	
Testing and inspection results must be documented as evidence of compliance and as the basis for monitoring test repeatability. This entails the identification and control of the inspection status of products and processes through the use of “stamps” or other control devices. ISO 9001 specifically requires the use of authorized “stamps, tags, labels, routing cards, inspection records,” etc. to identify the inspection and test status. MIL-Q-9858A indicates that the control must be of a “design distinctly different from the Government inspection identification.”	
Useful criteria for checking the satisfactory nature of the testing and inspection processes of the contractor’s quality system include these samples:	
• Are there procedures for positively identifying the inspection status of products and processes?	References: ISO 9001, paragraph 4.10; Mil-Q-9858A, paragraphs 6.7; NHB 5300.4 (1B-1), chapter 7.
• Does documentation address the necessary inspection and test of preservation, packaging, and shipping of end items?	References: ISO 9001, paragraph 4.10.3; and Mil-Q-9858A, paragraph 6.4.
• Does contractor documentation provide effective control of inspection and process stamps, punches, or other control devices?	References: ISO 9001, paragraph 4.12; and Mil-Q-9858A, paragraph 6.7.
• Are provisions established and maintained to assure that all supplies and services submitted to the Government for acceptance conforms to contract requirements?	References: ISO 9001, paragraphs 4.2 and 4.10.3; Mil-Q-9858A, paragraphs 1.2, 1.3 and 5.1; NHB 5300.4 (1B-1), paragraph 1B703.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
QUALITY ASSURANCE: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PROCESSES Now that we have discussed the functional areas of quality assurance and suggested criteria for a satisfactory management system, the common activities resulting from this process should be somewhat academic. As a function, QA plays a key role in almost all tasks of a NASA contract including early design and verification phases. Only a representative sample of the vast array of activities has been covered. The contractor's quality program plan is a very important product of quality. NASA projects will usually require the contractor to prepare and maintain a plan to ensure contract compliance. The value of the quality plan is to address all quality activities for the project contract period or authorized phases. Internal audits should be an obvious output of the quality system. The audits provide QA management with the evidence of compliance to customer contract requirements. In addition, the internal audits can provide the Government a valuable insight into functional areas under control or potential problem spots. The other examples cited in the chart should be evident from routine observation of in-plant contractor quality operations. Training must occur to maintain the efficiency of the skilled work force as well as to train replacement and/or new employees. Work instructions as well as inspections and test planning are the written procedures and checklists to keep operations in tune and in control. The activities associated with product nonconformances can take various forms including MRB tickets and corrective action plans. Quality data should be plentiful in a satisfactory system. Metrics such as defect rates and scrap, rework, and repair trends should be readily available and published frequently for management review and action. Records for process control, stamp control, and suppliers should be maintained and should also be readily available for review.	Slide # I-32

SAFETY: DESCRIPTION

Slide # I-33

The contractor is required by various laws to provide a safe and healthful environment for conducting business. NASA contracts specify additional provisions to protect the best interests of the Government. These requirements mandate the contractor to have a safety management system. The system must provide a safe work environment for the employees, prevent accidents that may jeopardize Government property or injure personnel, and ensure employees comply with safety and health standards. Safety in the broadest sense will consist of two aspects: an industrial safety function and system safety engineering. System safety is an engineering discipline that is defined in NHB 1700.1 (V1-B), NASA Safety Policy and Requirements Document, as follows:

> "Application of engineering and management principles, criteria, and techniques to optimize safety and reduce risks within the constraints of operational effectiveness, time, and cost throughout all phases of the system life cycle."

Many contractors will procedurally maintain distinct policies and procedures for industrial safety and imbed the system safety procedures within the design engineering system. Because system safety engineering is so closely related to industrial safety, this training will address the two aspects together.

Contractor safety organizations and managers serve as the primary interface for NASA safety managers and officials. The safety function itself is often organized as an overhead staff department. If contractor business activities include flight operations, you most likely will see safety combined or closely related with flight safety and maintenance functions. Safety and security might possibly report to the same senior official such as the vice president of operations or human resources. The safety manager must have unimpeded access to top management and the freedom of interface across the entire organizational structure. System safety is usually an integrated part of the design engineering department.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
SAFETY: AREAS OF FUNCTIONAL RESPONSIBILITY (CONTINUED)	Slide # I-34

There are many aspects of contractor safety management systems including programs for flight; explosives; industrial safety; occupational health; maintenance of aerospace vehicles, facilities, and related ground support equipment; environmental protection; and hazardous materials storage and handling. For our discussion purposes, this training will group the safety responsibilities into loss prevention management, fire prevention, and system safety.

The first area of responsibility is loss prevention management. This includes management programs for the aspects mentioned previously such as the establishment and maintenance of a safe work environment, the prevention of accidents, and the promotion of industrial safety.

The second area of responsibility singles out loss prevention and addresses it as a discrete component. Fire prevention is given special emphasis because it involves events such as fire and aerospace vehicle crashes that have the potential to produce catastrophic results. The possible impact to lives, facilities and equipment, and the program mission cannot be overstated. Additionally, the consequences of such accidents can be extremely resource intensive to correct, prevent, and mitigate.

System safety engineering involves the application of scientific and engineering principles to deliberately consider, identify, and control hazards throughout all phases of the program or project design life cycle. Stated simply, it specifies, predicts, and evaluates the safety of the design system. Safety efforts of the contractor should start early in the system design life cycle so that unacceptable operational and system hazards can be identified, eliminated, and controlled.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
SAFETY: KEY PLAYERS	Slide # I-35

Although it may sound trite, it is necessary to remember that safety, just like security and quality, is everyone's responsibility. Managers and key individuals for the Government and the contractor can make safety a reality. As with our other management systems, this slide shows selected players that should be involved.

Key players on the Government side are the personnel assigned in-plant surveillance. These individuals are the ones who will most likely see contractor safety systems in the work area on a real-time basis. Because of the magnitude of some of the NASA contractor operations, DCMC may be delegated to play a key role in the area of safety compliance to program/project contracts. If resident, DCMC will already be assessing the contractor's safety and system safety management systems. This presents a company-wide perspective that is beneficial to the NASA program/project by identifying systemic safety issues and corrective action plans. The program/project manager, safety manager(s), and engineer(s) are definitely the Government individuals charged with the responsibility for instilling a program/project safety awareness and for defining, approving, and managing the contract requirements for safety.

The contractor has a similar list of key players. The safety manager and fire chief or marshal are the focal points for the industrial, occupational, and fire business safety programs. The system safety engineer integrates the internal engineering design effort to consider and incorporate project system safety requirements into the design. The company's chief engineer or vice president of engineering also plays a significant role by ensuring that the engineering management systems establish and integrate system safety in all the engineering disciplines. For instance, company engineering design and drafting manuals should have standard practices for all company design efforts.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
SAFETY: SATISFACTORY SYSTEM CRITERIA (CONTINUED)	Slide # I-36
The criteria for a satisfactory contractor safety system can be derived from the NASA contract and Federal, State, and local codes and standards. The contractor's procedures themselves should be used for assessing compliance with these codes and standards.	
In general, the contractor's system must be established through written policies and procedures. The documentation should clearly define and describe the responsibilities for the loss prevention programs. The system has to address training and certification for employees. A definite requirement is to include procedures that address hazard identification and education of employees. Safety does not customarily have resources to continuously monitor all operations. Accordingly, procedures must ensure that internal audits are conducted.	<u>Example</u>: An audit of factory shops for compliance to the wearing of safety glasses is an example of one of these procedures.
Processes should be defined to ensure the timely and adequate preparation and control of customer requirements such as safety program plans, emergency preparedness plans, and facility compliance plans. Plans must be in existence for accident and mishap contingencies, the formal reporting of incidents, and their remedies. The system should even allow for safety drills and employee accidents or illnesses. Procedures should address special employee apparel and physical requirements such as vision, hearing, and ergonomics.	
Sample questions to ask include the following:	
• Are the responsibilities and authorities for contractor loss prevention programs clearly assigned and described?	<u>Reference</u>: NHB 1700.1 (V1-B), paragraph 203c-e
• Do the contractor procedures require and specify internal audits to include inspections of safety equipment such as fire extinguishers, eye wash basins, etc.?	<u>Reference</u>: NHB 1700.1 (V1-B), paragraph 203h
• Does the contractor system address the management review of systemic problems and their remedies?	<u>Reference</u>: NHB 1700.1 (V1-B), paragraph 203h

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
SAFETY - SATISFACTORY SYSTEM CRITERIA (CONTINUED)	Slide # I-37
This distinct function of loss prevention must have well-documented procedures that spell out authorities and responsibilities. The potentially catastrophic impact of a major fire or flight operations accident leaves no room for error. The contractor must be able to address contingencies and maximize their prevention.	
Training is a vital part of fire prevention and the system must have procedures to ensure it occurs. Contractors are required by NHB 1700.1 (VB-1) to develop employee motivation, awareness, training, and certification programs.	
As with management of any task, audits or self-evaluation must be an integral part of fire prevention. The audit activities must be systematically established to ensure compliance with contract requirements and local fire codes. The system must include provisions for corrective action and for management review.	
Procedures must exist to ensure the readiness of fire and rescue equipment. This includes inspection and tests for their usability. It should be noted that some contractors rely in part on local municipal fire departments for protection. The system should require review for their currency and adequacy. For example, joint drills with the local fire departments are vital to establish and validate response times and fire risks.	Example: Fire extinguishers are a simple piece of equipment, but must be inspected and maintained.
Suggested questions on the contractor's system should be similar to these:	
• Does the contractor's system adequately cover all contractual requirements?	Reference: NHB 1700.1, paragraphs 203c,e.
• Do the contractor's policies and procedures ensure fire protection personnel are adequately trained, qualified, and certified as needed?	Reference: NHB 1700.1, paragraphs 203c,f.

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SAFETY: SATISFACTORY SYSTEM CRITERIA (CONCLUDED)

A satisfactory system safety system will formally document a disciplined approach to achieve customer requirements. The system will cite authorities, responsibilities, and methods to resolve identified hazards and unsafe conditions.

Organizational lines of communication must be established for the internal and external system safety interfaces. Management guidelines will be defined to integrate the various engineering skills needed to focus on the contract goals. The coordination and integration of these technical skills must begin early in the design life cycle. This integration involves two-way communications. The safety engineer must advise the design engineer of the contract requirements. Likewise, the design engineer must consult with the system safety engineer on design characteristics that might impact system safety goals.

A satisfactory system will ensure employee compliance with NASA and OSHA requirements. In NASA's case, the system will generate an acceptable contract Safety Management Plan as required by NHB 1700.1 (V1-B). Execution of the plan will identify hazards and the risks associated with them. The plan will also identify the methods to eliminate and control unacceptable system safety risks.

Suggested questions to evaluate a contractor's system might include the following:

• Do procedures state company policy and safety goals?

• Are authorities and organizational lines of communication defined for system safety?

• Does the contractor's system ensure system safety engineering techniques are required to result in effective hazard identification and risk assessment?
</td><td>
Slide # I-38

<u>Reference</u>: NHB 1700.1 (V1-B) Appendix E
<u>Reference</u>: NHB 1700.1 (V1-B) Appendix E.

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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
SAFETY: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS The safety process will produce many products. The Safety Program Plan is one of the more visible efforts since most projects will require contractual delivery. Execution of the plan will by necessity produce other products and activities such as the ones listed on the shown chart. The contractor's management system itself should provide formal written documentation detailing the internal safety procedures. The various techniques and methods to be used in identifying and assessing hazards should be identifiable products and significant project activities. To in-plant Government personnel monitoring safety matters, one of the key activities that should be readily noticeable is coordination among the contractor program management team. For example, the various hazard analyses require inputs from many engineering disciplines. Design changes such as Class I or even Class II changes should involve the system safety engineer's review.	Slide # I-39
DESIGN ENGINEERING: DESCRIPTION The contractor engineering function will certainly be a focus for Government design interests. The assigned contractor engineers supporting a specific NASA program or project may be matrixed out of the appropriate engineering department. If the contract effort is of a large scope, the engineers may be assigned long-term as members of the contract program team. In either case, the engineers are expected to follow the company design policies and procedures controlled by the parent engineering department. For our training, engineering is used in the common way. A typical dictionary gives a definition similar to the one shown here. The message is that engineering uses science and mathematics to make property matters, useful products, or processes. Design management is using the engineering skills to transform NASA requirements into an approved hardware or software product. We will now address the major aspects of a contractor's engineering management processes. The scope of this training will not teach the professional engineering skills or disciplines but will cover only an overview of the contractor functional management system.	Slide # I-40

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: AREAS OF FUNCTIONAL RESPONSIBILITY	Slide # I-41

As mentioned in other training modules, the NASA mission dictates a variety of engineering requirements and tasks. The individual NASA contract will require its own unique set of disciplines and skills. Contractors usually choose or migrate over time to a specialized commodity or expertise in an area such as aerospace, space, aircraft, electronics, communications, and power plants/propulsion. To address all these fields of engineering applications would be enormous. We want to concentrate instead on the processes that may be involved in managing the engineering. Experience has shown, regardless of the commodity field, most contractors will operate with the following generic or functional areas:

- Design Management
- System Safety Engineering
- Configuration Management
- Reliability and Maintainability
- Test Management
- Integrated Logistics Support

This chart lists the first four. On the previous chart, we defined design management in the broadest sense. Stated slightly differently, as a function, it generally refers to the planning and integration of all the various engineering disciplines and techniques such as design analysis, configuration control, test and evaluation, and computer-aided analysis.

Although previously covered as part of safety, system safety engineering is again listed here to show it as a integrated part of the design process. Configuration management is the identification, documentation, and control of the functional and physical characteristics of design configuration items. Reliability focuses on the duration or probability of failure-free performance under a defined environment. Closely related, maintainability is the probability that an item will be retained in or restored to a specified condition within a given period when maintenance is performed. We'll discuss these two together due to their close design relationship.

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The test and management function provides the engineering guidance on the overall management of hardware and software tests. Policies and procedures address the top-level management of the engineering development, qualification, tests, and acceptance tests for a design configuration item.

Integrated logistics is the management and technical process for integrating supportability and logistics considerations into the early design activities. Often treated as a broader function than engineering, we will discuss its management functions under engineering to show its close ties to design. NASA's interest in integrated logistics is to assure that program/project systems are operable, available, and affordable for operations.</td><td>Slide # I-42</td></tr>
<tr><td>DESIGN ENGINEERING: KEY PLAYERS

For this functional management area, key players will consist of those individuals involved in the design and engineering activities. For the Government, in-plant personnel should play a significant role because of their in-depth, real-time visibility into the contractor's internal business. The program or project manager will play a key role through overall leadership of design objectives. The assigned engineers on the program/project will be influential by the nature of their assigned responsibilities for the design and development.

Although FAR Part 42 engineering functions are frequently withheld on NASA contracts, resident DCMC personnel can provide valuable information on contractor engineering functions. Because of the company-wide nature of contractor management systems, system issues and problems experienced on assigned Military programs may also be generic to any contractor effort, including NASA's.

The contractor's key players will be spearheaded by the Vice President of Engineering and/or the company chief engineer. These individuals will establish and manage the overall company engineering philosophy to include long-range strategies for new developments and design goals. The assigned project chief engineer, functional engineers such as system safety and reliability, and the component engineers will be highly visible players particularly during the early design and development phases. In fact, these individuals will most likely serve as the primary interface to the Government. You should expect to see these personnel at all the program reviews, design reviews, and technical interchange meetings.</td><td>Slide # I-43</td></tr>
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: SATISFACTORY SYSTEM CRITERIA	Slide # I-44

Design management policies and procedures must be adequately documented to bridge company-wide design efforts. To be effective, the procedures must interweave all the engineering functions and activities throughout all the phases of a design life cycle. This involves the spectrum of program and design reviews, technical analysis, specification/drawing development and approvals, testing and evaluations, and internal and Government audits. All of these activities require tremendous coordination, not only externally, but internally. For instance, design reviews and configuration audits require detailed engineering analysis, evaluation and presentation of test and analysis data, failure analysis, and needed corrective design changes for the selected component being reviewed. Interfaces must be absolutely defined and exercised with manufacturing and quality assurance to ensure integration of producibility, inspectability, and testability requirements. Of equal importance, system procedures must be extended to the subcontractors and vendors.

Aside from the level of Government design reviews, the contractor must have an internal design review process that independently checks and validates design decisions, assumptions, and trade-offs. On major projects, many contractors have established processes for independent tiger or red team validations. Internal audits or self-evaluations support the management disciplines to ensure policies and procedures are uniformly and consistently followed.

Here are several examples of questions to evaluate a contractor's system regarding design management functions:

- Do the contractor's procedures define the authorities and responsibilities for integrating and coordinating the various design processes and activities?
- Are design requirements coordinated with other functional departments such as QA?
- Do procedures exist for independent verification of design analysis, trade-offs, etc.?
- Do procedures exist to ensure closed-loop feedback of design-related nonconformances?

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: SATISFACTORY SYSTEM CRITERIA (CONTINUED) System safety was discussed earlier and will not be repeated here. An adequate configuration management (CM) system will be documented and assign the authorities and responsibilities to identify and document the physical and functional design characteristics. Organizational roles must be clearly established to ensure fulfillment of the contract tasks and assign accountability. The CM system itself can be simple for a small design or rather complex when a major program or project baseline is involved. In all cases, contractor procedures must address the standard practices of CM: definition and establishment of the design baseline (identification); discipline of making changes to the established baseline (control); maintenance of the precise status of the baseline and a clear audit trail of authorized changes (accounting); and the verification that the as-built baseline has been incorporated into the product (verification). A process must exist for the Configuration Change Board (CCB). The CCB must have formal membership assigned with precise steps for the change cycle. Coordination with quality, manufacturing, and system safety must be specified. Change need, classification, form, content, and rationale must be formalized. Also, procedures must address interface with the customer as well as the formal submittal of proposed changes for concurrence or approval. Sample questions for system adequacy concerning configuration management consist of the following: • Do the procedures specify the authority and responsibilities for design change identification, control, and accounting? • Is the CCB established with clear authority for managing changes? • Is there a process for auditing the configuration system for compliance to contract terms? • Are procedures established to conduct functional and physical audits?	Slide # I-45 Note: This function is discussed in module VI.B.2, Configuration Management.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: SATISFACTORY SYSTEM CRITERIA (CONTINUED) As with other engineering processes, an adequate reliability and maintainability function will be documented. It will formally assign the responsibilities and authorities for achieving contract goals. Procedures must ensure involvement of assigned personnel from early planning through the entire design life cycle. Processes to define and monitor goals must be established with corrective action mechanisms. Interfaces are required to receive and analyze data from manufacturing and quality to assess the achievement of goals. Reliability and maintainability contract requirements must be reviewed and integrated into the design cycle. Techniques and methods for conducting analysis must be specified to ensure the achievement of required contract levels of reliability. Mechanisms to address contract requirements such as parts selection must be established. Here are some key questions as to adequacy of the system regarding the functions of reliability and maintainability: • Does the contractor have a defined and documented system to address contract reliability and maintainability goals and their fulfillment? • Do procedures define the methods and techniques for conducting reliability analysis? • Do channels of communication exist with other functions to assess and receive reliability data?	Slide # I-46
DESIGN ENGINEERING: SATISFACTORY SYSTEM CRITERIA (CONTINUED) An adequate test management system must provide overall guidance concerning how hardware and computer software tests will be managed. The procedures should be established at a company-wide management level to ensure the independence and consistency of the testing verification objectives. Procedures must address the management aspects of development, qualification, and acceptance tests. For example, procedures must be specified for the activities of planning, organizing test operations, coordinating organizational support, directing the actual operations, and controlling test configurations and data. The policies and procedures should also address the correction actions for test anomalies and failures. Test results and data must be integrated back to the various engineering functions such as design and reliability.	Slide # I-47

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: SATISFACTORY SYSTEM CRITERIA (CONCLUDED)	Slide # I-48
To be adequate, contractor procedures must address the assignment of responsibilities and the authorities to perform the logistics tasks. To satisfy NASA contracts, procedures should specifically detail the processes to support and integrate the nine Integrated Logistics Support (ILS) elements as defined in NHB 7120.5, Chapter 7, into the design and development life cycle. • Maintenance • Training • Support Equipment • Design Interface • Supply Support • Transportation • Technical Data • System Facilities • Human Resources/Personnel Planning	
The contractor system must document the procedures and management activities to achieve ILS objectives. Specifically, the techniques for conducting logistics support analysis (LSA) and integrating results into contract design efforts must be formalized as procedures. The LSA process must ensure all nine elements are addressed.	
The system must ensure that communication is defined and implemented among the ILS function and design engineers. For instance, all design changes should be reviewed and assessed for compatibility with ILS objectives.	
Questions that can assist in determining contractor ILS support adequacy are as follows:	
• Are procedures in existence and documented to ensure ILS elements are integrated into contract design activities?	Reference: NHB 7120.5, chapter 7, Section D intent
• Are design changes assessed for ILS objectives and properly coordinated with ILS activities?	Reference: NHB 7120.5, chapter 7, Section D intent

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DESIGN ENGINEERING: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS	Slide # I-49
The activities involved in a typical contractor's engineering functions can be almost endless. The particular NASA program mission and its contract can significantly influence the type, scope, and timing of many of the activities. This charts lists just a small sample of those possible.	
The design products, such as specifications and drawings, are obviously significant products since they define the design. The internal contractor checks and balances that generate the design and the subsequent formal interface with NASA managers to approve the design concept are equally major events. Other key events, such as the configuration audits, then establish the baseline for production and Government acceptance.	
The activities involving configuration design changes usually require significant efforts for both the contractor and Government team members. The routine products resulting from configuration activities include class I and II design changes and major waivers and deviations.	Note: Training module VI.B.2 discusses these products.
Products such as program plans are of significance in establishing the contract understanding and agreements. The plans detail the techniques and methods for conducting the contract design and development tasks.	
Other products that are quite common for NASA major programs and projects include various engineering analyses as well as test data and reports.	

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
GOVERNMENT PROPERTY: DESCRIPTION The Property Management function serves as the interface for the Government property interests. The Federal Acquisition Regulation (FAR) Part 45 - Government Property prescribes policies and procedures for providing Government property to contractors. Part 45 gives this definition: "Government property means all property owned by or leased to the Government or acquired by the Government under the terms of the contract." In this definition, property means all property, whether real or personal. It includes facilities, material, special tooling, special test equipment, and agency-peculiar property. The description of material, facilities, and plant equipment is straightforward. Special test equipment refers to test units engineered, designed, fabricated, or modified to accomplish special purpose testing for a contract. Special tooling is tooling of such a specialized nature that it is basically limited to the development or production of particular supplies. As listed in FAR Part 45, special tooling includes jigs, dies, fixtures, molds, patterns, taps, gauges, etc. The contractor property control system is required to be reviewed and approved by the Agency for Contract Administration at the contractor's facility. Normally, for NASA, the contract administration services agency is DCMC. If the amount of Government property in the contractor's possession is substantial, you may find property as a separate functional department within the contractor's organization. Often, property will be a distinct part of a material management department or contracts.	Slide # I-50 Note: FAR Part 45 will be covered specifically under training module II.C.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
GOVERNMENT PROPERTY: AREAS OF FUNCTIONAL RESPONSIBILITY For our discussion purposes, we will divide the Government Property Systems into functional responsibility areas of property administration and property clearance. Property administration involves the contractor activities that are used to manage the Government property that is in their possession as a part of a contract. This involves the control, protection, preservation, and maintenance of the property. Functions normally associated with property administration include property acquisition; receiving; inventory control, utilization, and consumption; maintenance; subcontractor control; and contract closure. The second area of functional responsibility is that of property clearance. This involves designating property that is in excess of the contract requirements and disposing of the excess inventory.	Slide # I-51
GOVERNMENT PROPERTY: KEY PLAYERS As with all other types of contractor management system surveillance, NASA in-plant personnel can play a vital role in supporting property administrators. Awareness of Government property status and condition can help the property administrators with tasks such as planning availability and maintenance of property. The role of the property administrator whether delegated to DCMC or retained by NASA is especially important. As an authorized representative of the contracting officer, the administrator's role is to protect the Government property interests during all contract phases from acquisition through disposition. FAR Part 45 requires a formal review of the contractor's property system to assess compliance with the contract property clauses. A similar role will be required of the plant clearance officer in managing the disposition activities of declared excess property.	Slide # I-52

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
The contracting officer plays a key role by making approval or disapproval decisions regarding the contractor's system. This requires close interface with the property administrator. Also, the contracting officer will make disposition decisions for Government property designated as excess to requirements. Normally, if DCMC personnel are responsible for the contract administration at a facility, they will play a strong supporting role in the review and approval of a contractor's property system in accordance with FAR Part 45. Their review and approval of a system are usually binding for other agencies based on inter-agency agreements. NASA delegations may assign property administration and plant clearance functions to resident DCMC personnel. The contractor property manager is the key interface for the contractor. If the Government property effort is of a large scale, this position may be at the vice presidential level. Typically, administrators will perform specific contract requirements, and QA inspectors will support the property inspections.	Slide # I-52 (concluded)
GOVERNMENT PROPERTY: SATISFACTORY SYSTEM CRITERIA The contractor's property system must clearly delineate the responsibilities for controlling the various types of government assets. This requires defined lines of communications and feedback among the contractor functional divisions. Internal audits must assess compliance with policies and confirm that there is an established corrective system.	Slide # I-53

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
The system must ensure that the acquisition of Government property is based on valid requirements. For example, the system should specify procedures to use material breakdown lists for deriving requirements as well as a mechanism for timely updating of changes. Receiving procedures must require the use of written receipts and the handling of discrepant shipments. Accountable property records are mandatory parts of the system. The contractor must establish and maintain a system to account for, control, and safeguard all Government property. Adequate utilization and consumption procedures must be established and used for justification of utilization and consumption of Government assets. A preventative maintenance program must exist for all property needing periodic maintenance.	Slide # I-53 (concluded)
Because the contractor is responsible and accountable for assigned Government property, the system must contain procedures to control property located with subcontractors or alternate locations. Such property must be maintained in the prime contractor's property control system.	
Here are some possible questions to address system FAR Part 45 adequacy:	
• Does the contractor identify and assign responsibility for property control?	Reference: FAR Part 45, paragraphs 45.502 and 45.509-2).
• Does the property system require subcontractors to comply with the contract requirements?	Reference: FAR Part 45, paragraph 45.502(d)).
• Does the property system require the proper care, maintenance, and use of Government property in accordance with sound industrial practice and the contract?	Reference: FAR Part 45, paragraph 45.509.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
GOVERNMENT PROPERTY: SATISFACTORY SYSTEM CRITERIA (CONCLUDED)	Slide # I-54
The second aspect of a contractor's property system is that of declaring Government property excess when it is no longer required for contract performance. The contractor property system must delineate the methods and documentation to support the allocability of property declared excess on Government contracts. The authorities and responsibilities must be assigned to ensure effective disposal. Procedures must also ensure the prompt reporting of any loss, damage, or destruction to NASA.	
Since the contractor must report and certify property declared excess, procedures must ensure the contractor can substantiate the declarations. The system must ensure that the disposition of excess property is effective and efficient. Prior to disposition, the system must contain provisions for maximum internal reutilization prior to declaring property is excess. This also involves providing inventory schedules to the Government that describe the excess inventory. This latter requirement will promote Government reutilization screening efforts. The eventual selling and disposition procedures must be spelled out for the system to be considered satisfactory.	
Questions to address adequacy might include the following:	
· Does the contractor property system have effective and efficient methods for prompt reporting and disposition of excess Government property?	Reference: FAR Part 45, paragraphs 45.502(g) & 45.606-5.
· Do procedures address the substantiation of claims for property declared excess to contract requirements?	Reference: FAR Part 45, paragraph 45.606-5.
· Do procedures require the prompt reporting of property in excess of amounts needed to perform the contract?	Reference: FAR Part 45, paragraph 45.502(g).

GOVERNMENT PROPERTY: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS

Slide # I-55

Because of the significant dollar value of Government property, literally valued in the billions of dollars, the property control system requires extensive documentation and formal records. FAR Part 45 specifies various standard forms (SF) for use in preparing and submitting information on Government property. This training will not detail these forms, but merely intends to advise the student of the tremendous amount of record keeping involved with Government property. FAR Part 45 discusses these requirements.

This chart shows types of information that is typically required. Generally, records must account for every item of Government property in a contractor's possession. Required information consists of the following:

- Name
- Description
- National Stock Number
- Disposition
- Quantity Received
- Unit Price
- Location

Inventory records maintained by the contractor are considered official Government records. The records must show audit trails for any disposition. Excess analysis should be an available product. Incidences of loss, damage, and destruction specifically require reporting as well as property deemed to be excess to that needed for continuing contract performance. Maintenance records should be readily available from the contractor to document the required maintenance history for required items.

The contractor property system itself should be well documented because of the extensive FAR Part 45 requirements. This also holds true for subcontractors that have been provided Government property.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
PURCHASING/SUBCONTRACT MANAGEMENT: DESCRIPTION The contractor is responsible for the adequacy and quality of supplies and services purchased in support of a NASA contract. The contractor's procurement or purchasing department is the focus for Government interests in the acquisition or purchase of hardware, software, materials, and services. The purchasing department manages such purchases. Purchased or subcontracted items usually compose a very large percentage of NASA contracts. To protect the Government's interest, the prime contractor's purchasing system is normally approved by the Government contracting officer for use on a contract. DCMC ACO may be delegated this function. For NASA prime contractors, the magnitude of the responsibility for the procurement function will often dictate a separate department with a vice president in charge. The department will have its own staff of buyers and vendor monitors. Support on matters such as quality and engineering will be provided by the appropriate technical or functional organization.	Slide # I-56
PURCHASING/SUBCONTRACT MANAGEMENT: AREAS OF FUNCTIONAL RESPONSIBILITY There is no one preferred manner that contractors use to organize their procurement functions. In this training, we will concentrate on the function's responsibility, which can be described in four broad areas: · Subcontract Acquisition Management · Subcontract Planning · Subcontract Award · Subcontract Administration	Slide # I-57

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
For our purposes, the use of a subcontract is to be interpreted in the general sense to mean any purchase of supplies, materials, or services from a supplier by a purchase order or contract instrument. A contractor's procurement or purchasing department may buy overhead consumables such as office supplies, janitorial supplies, and minor maintenance items. Our context of purchasing, however, will be restricted to the materials, supplies, parts, subcontracted components, and services that will directly support or be integrated into the contracted end item product. The area of acquisition management refers to the contractor's overall management of the purchasing activities for all phases of a program or project life cycle. Planning refers to the integration of the end-user customer contract requirements with the prime contractor's procurement of needed materials and supplies. The award area can be described as the steps needed to place an order or subcontract. This includes compliance to prescribed award criteria, price/cost analysis, negotiation, and documentation. The administration or subcontract management is an important area often overlooked. It refers to the post-award management of the subcontract or order.	Slide # I-57 (concluded)
PURCHASING/SUBCONTRACT MANAGEMENT: KEY PLAYERS Several Government players have a key role in the surveillance of the contractor's purchasing system. The resident office personnel will be aware of the performance status of suppliers and vendors that are classified as major or critical. This additionally involves awareness of those suppliers that have significant problems in quality, cost, or delivery. SR&MA personnel might also be asked or tasked to review contractor purchase orders for QA matters such as source inspection, corrective action, and flowdown of contract requirements. The program/project manager will be interested in the cost, schedule, and performance status. The contracting officer has the responsibility to approve the purchasing system. The small-business manager will be involved in contractor purchases to the interest of complying with contract goals for small and disadvantaged businesses.	Slide # I-58

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DCMC/DCAA, if in residence, will be involved in surveillance of the purchasing system particularly as related to DOD contracts. In fact, a DCMC administrative contracting officer will more than likely be the Government contracting officer who approves the purchasing system. Contractor key players will consist of the purchasing director/manager or Vice President of Purchasing (if scope requires), QA inspectors, and the purchasing department buyers. The purchasing manager will establish the overall direction of the company purchasing policies. QA will have oversight of the supplier's quality control along with assigned contractor representatives at the vendor facilities. The contractor project manager and component managers will be involved in integrating the supplier components into the overall project, plus resolving problems and corrective actions as required.	Slide # I-58 (concluded)
PURCHASING/SUBCONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA The contractor procurement or purchasing system must address the authority and responsibility for managing the procurement of supplies, materials, and services needed to produce the contract end item. These policies and procedures must establish the company attitude towards purchasing, such as a rigid quality and a competitive approach. Supervision and self-evaluation audits must be described and executed through the procedures. The ethics, integrity, and dollar value of the purchasing orders mandate that a system of checks and balances be invoked. The internal audits must ensure compliance to Government contract terms for competition, truth in pricing data, small business set asides, etc. The functional responsibilities and lines of authority for communications with the subcontractor must be specified. A design engineer, for instance, must process a design change through the cognizant purchasing buyer rather than working directly with the supplier. In-plant experience has shown serious problems in design and configuration control can occur if communications are undisciplined.	Slide # I-59

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
PURCHASING/SUBCONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONTINUED) Adequate planning in advance of actual placement of purchase orders or subcontracts is a prerequisite for effective procurement of materials and services. The procedures should ensure that customer contract cost, schedule, and performance requirements are integrated and controlled with procurement planning. This planning must require consideration of competition as well as small and disadvantaged business goals. A key requirement of adequate planning is the establishment of criteria for awarding subcontracts and purchases. The criteria should address factors such as quality rating, technical merit and complexity, delivery needs, long lead time, past performance for delivery, and quantity discounts. Methods and points of inspection are equally important planning factors.	Slide # I-60
PURCHASING/SUBCONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONTINUED) The system must rigidly establish procedures to ensure the award planning criteria are followed. Detailed cost and price analysis must be performed to ensure the best contract value. To be more effective, the system may specify the analysis techniques to be used for certain types of awards. The negotiation process must provide adequate documentation to justify the award. Adequate documentation also supports future cost and price analysis. This need for adequate documentation follows the same philosophy used by the Government in negotiations with prime contractors. The prime contractor must also certify certain cost and price data when the costs are flowed back to the Government contract.	Slide # I-61

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
PURCHASING/SUBCONTRACT MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONCLUDED) Subsequent to award of a subcontract or purchase order, the contractor must ensure the subcontractor or vendor complies with the contract and delivers the required product or service. To be effective, the prime contractor procedures must provide the cost, schedule, and performance visibility to measure subcontractor compliance. The methods to achieve the desired degree of visibility should be specified.	Slide # I-62 <u>Example</u>: Inspection at source or primary reliance on receiving inspection at the destination, if any, should be detailed.
PURCHASING/SUBCONTRACT MANAGEMENT: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS The Government Contractor's Purchasing System Review (CPSR) is an extremely important activity. As presented in FAR Part 44, CPSR is defined as follows: "... the complete evaluation of a contractor's purchasing of material and services, subcontracting, and subcontract management from development of the requirement through completion of subcontract performance. " This review, frequently conducted by DCMC, provides a major input into the approval or disapproval of the purchasing system. Other key activities include the contractor audits of individual purchase order files or folders. The contractor should maintain metrics on the entire purchasing system and on individual subcontractor performance. Many contractors conduct periodic baseline reviews of vendor/subcontractor performance. This can be a team review or programmatic type review. Consent to subcontract is required under FAR Part 44.201 "... when the subcontract work is complex, the dollar value is substantial, or the Government's interest is not adequately protected by competition and the type of prime contract or subcontract."	Slide # I-63

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
Unless waived by the contracting officer, these consents can be significant events. The DCMC/DCAA reviews of purchase order folders is also important information on the adequacy of the purchasing system. The Government does conduct sampling of selected folders for compliance to the system and contract terms. Contractor audit reports and vendor ratings provide very useful insight into the merits of individual suppliers quality and compliance to subcontracts.	Slide # I-63 (concluded)
MANUFACTURING OPERATIONS: DESCRIPTION The contractor's manufacturing operations is the point of interest for Government manufacturing matters. This function has the responsibility for transforming the design into the finished product. The Defense Systems Management College in their Defense Manufacturing Management Guide defines manufacturing as follows: "The conversion of raw materials through a series of ... procedures and processes." Because of the size and magnitude of the tasks, manufacturing operations is normally an organizational department or division.	Slide # I-64
MANUFACTURING OPERATIONS: AREAS OF FUNCTIONAL RESPONSIBILITY A large program or project contractor with multiple customers or business interests is often organized along product lines or process operations. Regardless of the business unit organization, basic functional tasks are assigned to manufacturing. We will discuss manufacturing as a function along the following areas: · Manufacturing Management · Work Measurement · Manufacturing Engineering · Production Scheduling and Control	Slide # I-65

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
· Manufacturing Planning · Traffic Management · Facility Management · Packaging, Handling, and Transportability Manufacturing management alludes to the overall manufacturing management system, including the areas of production operations, traffic management, and packaging and handling. Manufacturing engineering is distinct from the design engineering and quality engineering functions. Manufacturing engineering is primarily tasked to provide the basic identification and best methods for manufacturing an end item.	Slide # I-65 (concluded)
MANUFACTURING OPERATIONS: AREAS OF FUNCTIONAL RESPONSIBILITY (CONTINUED) The manufacturing planning element deals with the integration of the work force, materials, tools and equipment, and manufacturing processes towards the objective of producing the end item. Facility management addresses the optimization of the plant layout, equipment usage, and material handling. For a manufacturer with large facilities, this area is particularly important to reduce the loss of time in moving parts from one process to the next. Work measurement focuses on the effective use of the labor work force through the measurement of performance against established engineering standards. Work measurement also concentrates on the correction of conditions that cause work inefficiency.	Slide # I-66 Example: Before optimizing the factory layout, one manufacturer calculated a part traveled in excess of 20 Miles in the factory before it became a finished item.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
MANUFACTURING OPERATIONS: AREAS OF FUNCTIONAL RESPONSIBILITY (CONCLUDED) The area of production scheduling and control relates to the forecasting, scheduling, and controlling of workloads. The area concentrates on systematically distributing and releasing the personnel resources and material on a daily basis to the manufacturing processes or shops based on available manpower, material, and equipment. Traffic management services include the tasks of preparing and arranging for shipments to include the documenting, tracing, and routing. In other words, this function makes the arrangements for the required shipments of contract deliveries. It deals with the contractor's abilities and procedures for common carrier inbound and outbound transportation and fleet operations. Packaging, Handling, and Transportability (PH&T) relates to the designing and testing of the packaging for specification shipping and handling environments and to preparing the product for transportation. This function requires a close interface with design engineering, manufacturing shops, and transportation.	Slide # I-67
MANUFACTURING OPERATIONS: KEY PLAYERS Many Government and contractor key players are involved with manufacturing operations. This chart shows a representative sample of those frequently involved. The in-plant NASA personnel can help in this area in the same way as they can with other areas needing real-time surveillance. The Government manufacturing and industrial engineers and the specialists are all key in assessing production status as well as resolving problems that arise. Traffic managers and transportation officers are definitely also catalysts in this area. For Government shipments, they arrange and plan for a reliable carrier. It does little good to produce a product if shipment is delayed due to lack of communications or planning.	Slide # I-68

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
The contractor manufacturing team can be rather large, but they are players that can make things happen. The ones shown on this chart are ones who are in a particularly good position to be a liaison for the surveillance of manufacturing progress.	Slide # I-68 (concluded)
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA The size of a manufacturing workforce and the technical nature of the operations makes a well-written system mandatory. Accordingly, the system must be completely and satisfactorily documented regarding policies and procedures. The usual management tasks of planning, organizing, and directing should be addressed. Communications among the many elements are equally important. Top management objectives must be effectively communicated throughout the function, including the engineers and operators. Another requirement of the system should be to contain effective internal audit practices and procedures. An effective audit function will be designed to identify deficiencies and address the corrective action. The audits should span all activities of the entire manufacturing operations.	Slide # I-69
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONTINUED) The manufacturing engineering portion of the system must be concerned with the interface between design and production. The interfaces should be well defined and descriptive. Procedures must specify the techniques and methods implemented to ensure that all considerations for satisfying the design interface are taken into account. Procedures should ensure the proper equipment, tools, and software are selected to convert the design into the deliverable end item.	Slide # I-70

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
Procedures must ensure manufacturing engineering is fully integrated with quality engineering and design engineering disciplines such as reliability, maintainability, predictability, and human engineering. The system must ensure that manufacturing engineering is in total sync with design engineering activities. This ensures the readiness and ability of manufacturing to accept and transform the design into the finished end item. Make or buy must also be addressed.	Slide # I-70 (concluded)
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONTINUED) As indicated earlier, planning is concerned with the integration of the work force, materials, equipment, machine tools, and manufacturing processes to properly produce the engineering design. The manufacturing processes will be those identified by manufacturing engineering. The main criterion for a satisfactory planning system is that the contractor's documented system assures each customer program is thoroughly covered and integrated into the plant-wide Master Production Plans. The program/project Master Production Plan is the primary source for integrating all supporting elements of manufacturing including facilities, tooling, vendors, materials, assembly, and delivery. The manufacturing system must ensure that processes exist to identify all critical paths of product flow, prepare the flow paths, document all planning, and permit the adjustment of changing requirements. The planning system must also ensure that the written procedures and work instructions produce timely and accurate planning to integrate the program into the plant-wide production plan. This means that discipline must be enforced to produce clear, current, and accurate work instructions. The system must establish the requirement for regular review of the documentation and ensure its continuing validity is traceable to the approved design documentation and manufacturing planning.	Slide # I-71

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
Questions to consider for system adequacy concerning manufacturing planning should resemble the following: · Do the contractor policies and procedures identify and assign responsibilities for integrating the contract Master Production Plan into plant-wide planning? · Do planning procedures ensure the currency of work instructions to meet the program planning?	Slide # I-71 (concluded) Reference: ISO 9001, paragraph 4.9.1 and 4.9.2; Mil-Q-9858A, paragraph 6.2 Note: See example Master Schedule in Defense Manufacturing Management Guide, Figure 6-6.
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONTINUED) To be adequate, the contractor's manufacturing management system must contain documented procedures that detail how facility management will achieve optimum plant layout, equipment utilization, and material handling. To be considered acceptable, practices for increasing productivity, reducing costs, protecting in-process inventories, and simplifying control must be established. A manufacturing operations system should place emphasis on contractor behavior that aggressively pursues the optimization plant and equipment use. Inherent in this objective is the requirement that written work instructions and procedures provide direction that supports prompt responses to production changes and instructions that address material handling risks. Questions to use for evaluating system adequacy concerning facility management include the following: · Do the written procedures assure that facility planning will be performed to address optimization of plant, equipment, and material handling? · Do the written work instructions provide for minimizing material handling risks?	Slide # I-72

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONTINUED) Whether or not the Government contract specifies work measurement requirements, the contractor's manufacturing management system must provide written procedures for the effective use of the labor resources. Criteria for an acceptable system for work measurement functions include the following: • The use of recognized industrial engineering techniques for establishing work standards. Adequate training must be a part of the contractor's system to ensure satisfactory performance to the established standards. • Likewise, an acceptable system must provide procedures for pursuing cost-effective methods improvement. In other words, an attitude of always seeking improvement is needed. • A management process must exist to review and analyze performance. Corrective action must be assigned to remedy causes of inefficiency. • Integration of work measurement into budgeting, estimating proposals, and scheduling.	Slide # I-73 Note: Work measurement involves the establishment of engineered labor standards against which actual performance is judged. A labor standard represents the time allowed for a normally skilled worker to acceptably perform a specifically defined task under normal conditions. Engineered standards use accepted practices such as time and motion studies. Note: The Defense Manufacturing Management Guide, Chapter 13, has a good discussion on work measurement.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONTINUED) Earlier, we discussed manufacturing planning. Here we will briefly address production scheduling and control. Although closely related to planning, the scheduling and control function is the detailed daily scheduling, distributing, and releasing of workloads to the manufacturing units or shops. Some contractors may combine this function with the planning function. A satisfactory scheduling and control function is generally one that has the following characteristics: · Accurately measures the available labor resources, material, and equipment capabilities · Allocates resources into a daily time frame with start and finish times · Includes routing, dispatching, and expediting of in-process items A satisfactory system will address the above criteria through documented procedures.	Slide # I-74
MANUFACTURING OPERATIONS: SATISFACTORY SYSTEM CRITERIA (CONCLUDED) Although they are inter-related, traffic management and packaging, handling, and transportability (PH&T) functions are different. As mentioned earlier, traffic management, in short, takes care of the preparations for and the shipment of products or items. PH&T takes care of preparing the actual product for the environment of transportation. Traffic management should adequately address the following: · Procedures to assign and describe the responsibilities for managing carrier inbound and outbound transportation · Procedures to ensure adequate services for shipping, routing, and tracing of Government shipments · Procedures to continuously examine the performance of carriers and internal capabilities to meet contract requirements	Slide # I-75 Note: Refer to NHB 6000.1D, Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment and Associated Components.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
A satisfactory PH&T should have the following adequate provisions: · Define interfaces with design, manufacturing, quality, and traffic management · Manage and assess subcontractors and vendors packaging performance · Continuously assess contractual requirements and contractor capability to comply · Meet contract spcifications on all products and/or end items shipped by the contractor as well as the vendors package · Ensure documentation reflects required contractor inspection	Slide # I-75 (concluded)
MANUFACTURING OPERATIONS: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS This chart and the next chart contain a sampling of the many activities and products of the manufacturing operations. The scope of this particular module will not permit a discussion of each item. Most have been cited in the previous discussions and should be faMiliar to you. The others are commonly used techniques and will be selectively described. · Bill of Materials: In general, a detailed list of the materials, items, finished products, or parts needed to make an end item. · Line of Balance: A graphic representation of the scheduled units versus actual units for a given period at a manufacturing control point. · Make or Buy: A contractor analysis that determines the suitability of buying an item or making it in-house by the contractor's own processes. · Capital Investment: A contractor's plan for long-range expenditure of capital funds to enhance manufacturing capability and improve or maintain a company's competitive posture. · Statistical Process Control: An analytical technique for evaluating processes and taking action to stabilize the process within defined limits.	Slide # I-76 Note: Definitions are taken in part from DCMC Defense Manufacturing Management Guide (April 1989)

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
· Fishbone Diagram: A technique developed by Dr. Kaoru Ishikawa that permits problem solving through a cause and effect flow diagram. The flow looks like a fishbone, thus, its nickname. · Yield Rate: For a given process, the rate of conforming items divided by the number of nonconforming items.	Slide # I-76 (concluded)
MANUFACTURING OPERATIONS: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS (CONCLUDED) This chart continues the discussion from the previous chart. · Lead Time Analysis: An analysis that estimates the amount of set-back time or lead time from a required start point in a manufacturing process; the lead time precedes the need date. · Tool Proofing: The verification of the configuration readiness of an item of tooling. · Materials Requirements Planning (MRP): A priority planning technique, usually automated, based on the theory of independent versus dependent demand. · Computer Aided Manufacturing: The application of computers to manufacturing procedures to automate planning and production processes. An example includes the programming of a machine. · Production Readiness Review (PRR): A Government review of the readiness of the design and production planning before committing a program or project to proceed into the production phase. · Parts Travelers/Folders: The formal documentation that accompanies a part or item to establish its process history and configuration; may also be called a traveler or work package.	Slide # I-77

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DATA MANAGEMENT: DESCRIPTION Deliverable contract data activities typically focus around the contractor's data manager. Even though it is not always a distinct office or department, there are important tasks that must be accomplished for deliverable data. Reliable data are essential to the operation and maintenance of program and project systems. Data become one means of communicating technical and operational information to the ultimate user. This portion of the training will briefly touch upon the contractor's management system related to the delivery of Government data. First, let's define what is meant by deliverable data. For our purposes, deliverable data generally mean any information and documentation that are required to be delivered by the NASA contractor. Examples are as follows: · Program/Project − Program Plan − Safety Program Plan − Configuration Management Plan − Contractor Metrics · Technical Documentation − Design Specifications − Drawings − Analysis − Technical Manuals · Financial − Contractor Cost Reports − Cost Data	Slide # I-78 <u>Note</u>: Refer to Module III.C, Contractor Interface, for a general discussion on Government rights including data.

<table>
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<tr><td>DATA MANAGEMENT: AREAS OF FUNCTIONAL RESPONSIBILITY

This training module will provide only an overview of contractor management systems related to data. A later module under Part VI, Contractor Performance, will address data management from a performance perspective. From the systems perspective, we will cover three general areas of interest.

Data management addresses the contractor management of all the various activities related to the data. The second area of interest is that of data planning and preparation. Next, data inspection and acceptance will be discussed.</td><td>Slide # I-79</td></tr>
<tr><td>DATA MANAGEMENT: KEY PLAYERS

Not surprisingly, the key players involved with data management are some of the same players discussed for the previous management systems. Once again, we should expect the in-plant people to be aware of contractor data activities in the same way that they are of other contract activities. The program or project Data Manager will definitely be a key player in surveillance of contractor performance.
The engineer, project manager, and financial analyst in the program/project office are surely interested and involved in the data associated with their functional area of assignment. The contracting officer will approve the data item.

If the contract requirements are significant, a contractor Data Manager will be assigned. For many contractors, data may be a responsibility of QA. The QA inspectors will have a key role in ensuring deliverable and especially technical data conform to the contract requirements. Because of the fact data management is a contract requirement with its own cost, schedule, and adequacy requirements, the contractor project manager and assigned project monitors will be actively involved.</td><td>Slide # I-80</td></tr>
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INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DATA MANAGEMENT: SATISFACTORY SYSTEM CRITERIA An acceptable data management system consists of these requirements: · Policies and procedures will exist to adequately define and assign responsibilities and authorities for data management. · The system will ensure an acceptable quality or inspection process is in place for controlling the quality of deliverable data. The procedures will ensure prompt detection and correction of deficiencies. · The data management system will include provisions to ensure contract Government verification and contractor validation requirements are clearly defined and described as to responsibilities. Government participation in these activities will be defined. · The system must ensure that subcontractors prepare and update technical data packages as an integral part of design, development, and production efforts.	Slide # I-81 <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.a.(4) <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.d; and good business practice. <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.c <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.a.(4).
DATA MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONTINUED) Acceptable data will not just happen. The contractor must start with a complete and thorough understanding of the contract requirements. Planning must then ensure the data are prepared, controlled, and delivered in the proper contract-required format and media. These requirements are considered essential for an acceptable data planning system: · The data system must ensure that deliverable data conform to the contractual preparation requirements such as electronic media. Requirements such as style, format, reproducibility, and legibility must be planned and verified. · The system must ensure that all changes, additions, or deletions directed by the contracting officer are incorporated prior to Government acceptance.	Slide # I-82 <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.a; and good business practice. <u>Reference:</u> NHB 7120.5, Chapter 5, Section I, paragraph 3.a; and good business practice.

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
· The procedures shall ensure that limited rights markings are proper and conform to contract requirements. (RE: NHB 7120.5, Chapter 5, Section I, paragraph 3.e; and good business practice). · Procedures must allow for preparation and control of data originals; originals, negatives, or other reproducible media must be properly packaged consistent with the contract. · When required by the contract, the data system must define and ensure internal procedures control and receive approval prior to formal Government acceptance.	Slide # I-82 (concluded) Reference: NHB 7120.5, Chapter 5, Section I, paragraph 3.a; and good business practice. Reference: NHB 7120.5, Chapter 5, Section I, paragraph 3.a;(7); and good business practice. Reference: NHB 7120.5, Chapter 5, Section I, paragraph 3.b; and good business practice.
DATA MANAGEMENT: SATISFACTORY SYSTEM CRITERIA (CONCLUDED) The system must contain provisions for the inspection and acceptance by the Government. Basically, NHB 7120.5 establishes the requirement for major programs and projects that "data shall be ordered, delivered, inspected, and accepted in accordance with the FAR and NASA FAR Supplement." In keeping with this, the following criteria are suggestions for a satisfactory data inspection and delivery/acceptance function based on in-plant surveillance experience: · Procedures must ensure in-process and final inspections confirm compliance of the data to contract requirements. · Data processes must be established to ensure that contractor and subcontractor prepare engineering and technical data consistent with approved configuration baselines. (NHB 7120,.5 specifies that the contractor "shall prepare and update technical data packages as an integral part of their design, development, and production effort"). · Procedures should have provisions for inspection as part of data verifications and validations. · Procedures should allow for planning and inspection activities of the Government data verifications.	Slide # I-83

INSTRUCTOR NOTES	TRAINING MATERIALS AND SUGGESTIONS
DATA MANAGEMENT: EXAMPLES OF SYSTEM ACTIVITIES AND/OR PRODUCTS The delivery and acceptance of contract data by NASA is the culmination of many preceding events. A data call will establish the initial contract data requirements for all potential users. Per NHB 7120.5, standard data item descriptions (DIDs) or data requirements descriptions (DRDs) will be used to specify the requirements. Tailoring of descriptions is encouraged by NASA to permit the acceptance of contractor format whenever acceptable to NASA requirements. The CDRL of the contract specifies the delivery requirements such as the DRDs or DIDs and the formal distribution of the data item. When specified by the contract, the contractor will be required to conduct validations for technical data. Such an activity validates the fact that the technical data accomplish their intended purpose when used with prescribed equipment or software. The Government will routinely witness the contractor operations. The Government verification activity is a siMilar event, but is conducted by the Government. Verification is the process by which Government operation or maintenance personnel test and prove the procedures in the technical data.	Slide # I-84
SUMMARY We have rather quickly covered a typical NASA contractor's management systems or, as occasionally referred to, processes. We started by presenting a simple definition of a management system and concluded that a management system is a network of company-wide objectives and policies passed from the COO to the functional area managers. We then addressed the Government's right of approval for the purchasing and property management systems. Equally important, the "right of disapproval" was discussed for the other systems that do not meet contract requirements. The bulk of our time centered on the overviews of the common contractor management systems in the following areas: · Contract Management · Quality Assurance	Slide # I-85

<table>
<tr><td rowspan="3">DETAILED OUTLINE OF INSTRUCTION FOR
MANAGEMENT SYSTEMS/PROCESSES</td><td>Course Number: V.B</td></tr>
<tr><td>Module: 1</td></tr>
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<tr><td>INSTRUCTOR NOTES</td><td>TRAINING MATERIALS AND SUGGESTIONS</td></tr>
<tr><td>· Safety (including System Safety)
· Design Engineering
· Government Property
· Purchasing or Subcontract Management
· Manufacturing Operations
· Data Management

For each of these areas, a description, the key players, suggested criteria for a satisfactory system, and some examples of activities were discussed.
At this point, we will conclude the training unless there are additional comments or questions.</td><td>Slide # I-85 (concluded)</td></tr>
<tr><td>WHERE TO OBTAIN MORE INFORMATION

This slide provides sources of additional information concerning management systems and processes.</td><td>Slide # I-86</td></tr>
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